

We claim:

1           1.       A method of operably interconnecting an electrooptic (EO) polymer  
2 waveguide and a passive polymer waveguide, comprising:  
3           providing a tapered electrooptic (EO) polymer waveguide interconnection  
4 structure between an EO polymer waveguide and a passive polymer waveguide.

1           2.       A method of fabricating a waveguide structure, comprising:  
2           coating a passive polymer lower cladding over a substrate;  
3           coating a passive core layer lower portion over the passive polymer lower  
4 cladding;  
5           curing the passive polymer lower cladding and the passive core layer lower  
6 portion;  
7           coating an electrooptic (EO) polymer layer over the passive core layer lower  
8 portion;  
9           etching the EO polymer layer to produce a tapered EO polymer layer with a  
10 tapered region;  
11          coating an passive core layer upper portion over the tapered EO polymer layer;  
12          etching the tapered EO polymer layer to produce a rib waveguide structure;  
13          and  
14          coating a passive polymer upper cladding over the rib waveguide structure.

1           3.       The method of fabricating a waveguide structure of claim 2, wherein  
2 the passive polymer lower cladding and the passive core layer lower portion are cured  
3 with ultraviolet (UV) light.

1           4.       The method of fabricating a waveguide structure of claim 2, wherein  
2 the passive polymer lower cladding and the passive core layer lower portion are cured  
3 in a nitrogen environment.

1           5.     The method of fabricating a waveguide structure of claim 2, wherein  
2     the EO polymer layer is etched by oxygen plasma with a shadow mask to produce the  
3     tapered region.

1           6.     The method of fabricating a waveguide structure of claim 5, wherein a  
2     fixed radio frequency (RF) power and gas pressure are employed for etching the EO  
3     polymer layer.

1           7.     The method of fabricating a waveguide structure of claim 5, wherein a  
2     width of a gap between the EO polymer layer and the shadow mask is selected to  
3     control a taper length of the tapered region.

1           8.     The method of fabricating a waveguide structure of claim 2, wherein  
2     the tapered EO polymer layer is etched by:  
3         printing waveguide patterns over the tapered EO polymer layer; and  
4         employing an oxygen reactive ion etching process to produce the rib  
5     waveguide structure.

1           9.     A waveguide structure, comprising:  
2         an electrooptic (EO) polymer waveguide;  
3         a passive polymer waveguide; and  
4         a tapered EO polymer waveguide interconnection structure between the EO  
5     polymer waveguide and the passive polymer waveguide.

1           10.    The waveguide structure of claim 9, wherein the EO polymer  
2     waveguide and the passive polymer waveguide provide single mode propagation, and  
3     the interconnection structure provides a coupling between the two waveguides without  
4     higher order mode coupling.

1           11.    The waveguide structure of claim 9, wherein an interconnection loss  
2     associated with the interconnection structure is less than 0.4 dB.

1           12.    The waveguide structure of claim 9, wherein the interconnection  
2   structure is vertically tapered.

1           13.    The waveguide structure of claim 9, wherein a taper length of the  
2   interconnection structure is 300  $\mu\text{m}$  or more.

1           14.    The waveguide structure of claim 9, wherein a taper angle of the  
2   interconnection structure is no greater than 0.4 degrees.

1           15.    The waveguide structure of claim 9, wherein the EO polymer  
2   waveguide and the passive polymer waveguide are formed as rib structures.

1           16.    The waveguide structure of claim 9, wherein the EO polymer  
2   waveguide has a higher refractive index than the passive polymer waveguide.

1           17.    The waveguide structure of claim 9, wherein the passive polymer  
2   waveguide has a larger mode profile than the EO polymer waveguide.

1           18.    The waveguide structure of claim 9, wherein the EO polymer  
2   waveguide comprises a nonlinear chromophore.

1           19.    The waveguide structure of claim 18, wherein the nonlinear  
2   chromophore includes a tricyanobutadiene acceptor and a phenyltetraene bridge.

1           20.    The waveguide structure of claim 9, wherein the passive polymer  
2   waveguide comprises a fluorinated polymer.

1           21.    The waveguide structure of claim 9, wherein the passive polymer  
2   waveguide comprises a fluorinated acrylate.